

AVIATION

AUGUST 13, 1923

Issued Weekly

PRICE 10 CENTS



Vought naval observation plane about to land on the deck of the U. S. aircraft carrier Langley

VOLUME
XV

NUMBER
7

SPECIAL FEATURES

COMPARING MODERN WING PROFILES

PROGRESS IN BRITISH CIVIL AVIATION

CURTISS RACING SEAPLANE MAKES WORLD'S RECORD

ADVANTAGES AND DRAWBACKS OF FLEXIBLE ENGINE MOUNTING

THE GARDNER, MOFFAT CO., INC.
HIGHLAND, N. Y.

225 FOURTH AVENUE, NEW YORK



Graduate Pilots and Instructors Presented to them with Flying Coats, Curtiss Flying School, Garden City, N. Y.

EQUIPPED AND READY TO FLY

Here they are—six men who have just finished their course at the Curtiss Flying School, with the machines presented to them upon their graduation. Each one knows his plane—conditioning and assembling it, and installing the motor each one procured for himself at nominal cost, was part of the required work.

How different from the early days! Then, learning to fly meant five thousand dollars—and another five for a ship. Even since the war, though the cost of instruction has been greatly decreased, the price of the plane itself has still been beyond reach of the majority. It remains for the Curtiss Exhibition Company to offer to men interested in aviation, for sport or for business, a combination of instruction, plus equipment, at a price within the means of almost anyone.

Five Hundred Dollars for Instruction and Plane Less Motor

For details as to terms, curriculum, enrollment dates, etc.,
Write for Flying School Booklet

CURTISS EXHIBITION COMPANY
GARDEN CITY, NEW YORK.



AUGUST 13, 1923

AVIATION

VOL. XV, NO. 7

Member of the Audit Bureau of Circulations

CONTENTS

Editorials	181	Waco "Six" Three-Seater	189
A Comparison of Some Modern Wing Profiles	182	New British Air Regulations	189
Collisions of Airplanes Recorded by Camera	183	Aerial Bombardment Maneuvers with Warships	190
Progress in British Civil Aviation	184	Trade of American Schneider Cup Entry	191
Has Your Town a Landing Field?	186	Airports and Airways	192
New British Aircraft at R.A.F. Pageant	187	U. S. Army and Navy Air Forces	194
Thrilling Meaning of Aircraft Engines	188		

THE GARDNER, MOFFAT COMPANY, Inc., Publishers

HIGHLAND, N. Y.

225 FIFTH AVENUE, NEW YORK

Subscription price: Four dollars per year. Single copies
ten cents. Canada, five dollars. Foreign, six dollars
a year. Copyright 1923, by The Gardner, Moffat Com-
pany, Inc.

Issued every Monday. Form close ten days previously.
Entered as second-class matter Nov. 25, 1910, at the
Post Office at Highland, N. Y., under act of March
3, 1879.

THOMAS-MORSE AIRCRAFT CORPORATION

CONTRACTORS TO U. S. GOVERNMENT

ITHACA,



NEW YORK



FINE craftsmanship is not a commodity readily purchasable in the open market.

It must have behind it a wealth of tradition, a high ideal, and a determination to live up to a worthy heritage.

Twenty years ago the builders of Wright Aeronautical Engines and Wright Planes introduced the first successful self propelled flying machines.

This Organization of engineers and builders have, ever since, given their best to the improvement and refinement of the flying art and its craft.

Until today no finer product of correct engineering practice nor wider experience in the production of engines and planes can be found in the entire field of international aeronautics.

WRIGHT AERONAUTICAL CORPORATION
Patterson, New Jersey, U. S. A.



WRIGHT

L. D. GARRETT
PRESIDENT
V. D. MORGAN
VICE-PRESIDENT
L. D. WRIGHT
MANAGER
L. H. NEWELL
BUSINESS MANAGER

Vol XV

August 13, 1923

No 7

AVIATION

LAMAR H. ORBIT
EDITOR
VICTOR E. CLARK
REDACTOR
RALPH H. LYNN
CONTRACTING EDITOR

A Real Loss

IN the death of President Harding, the American aviation world lost a true friend. The interest shown by the late President in our air development was not only genuine but sound. He showed in many ways that he realized in full sense the necessity of expanding our air activities, both governmental and civil.

While plans had been considered and definite outlines made by a majority of all National Defense Commissions in our Government, with a Secretary for Defense who would be responsible through accidents for the military, naval and aerial defense, the time had not come for concrete action. It is to be hoped that this cherished hope of President Harding will not be forgotten.

Words of assurance found in the President the same cordiality, sympathy and encouragement that made him so generally beloved. No effort to advance aviation seemed to be too great for him to make and such progress as has been made is due largely to his encouragement and support.

The Government that has come to the country as a whole from the successful war with particular generosity here, there were no differences of opinion, no debatable problems and no reason for friction. Where aviation will come the loss of a real friend of aerial progress.

Our River Airways

IN considering the present status of the proposed national survey system it is surprising to note that the numerous national surveys offered by America's numerous waterways are totally overlooked. Indeed, this is a point which seldom receives proper recognition, when as a matter of fact it deserves the most careful study.

A glance at a map will show that the Mississippi with its numerous tributaries offers an ideal set of river airways for linking up the most important centers of population of the central portion of the United States.

All this extensive territory has the most stupendous natural facilities for thousands of miles of airways of the safest kind—wide water, where an aircraft is constantly over a smooth landing field, and where engine trouble can therefore be diagnosed as a mere inconvenience. Thus, the so-called good communications of airports, emergency fields and markers, which often require a huge outlay and great difficulties over land, is almost automatically solved by nature on the river airways. The river is airport, emergency field and marker at the same time.

To open it to aerial traffic only requires a few ships, a few boats and a few men—as expense which is disproportionately small when compared to that involved in opposing land airways. Furthermore, rivers generally run through the heart of cities and towns, allowing for central

location of airports, as against remote locations on land, which makes for a very material saving of time in air traffic.

Another factor which handicaps public air service is the twelve hour operation of airplanes as against the twenty-four hour operation of railroads. This handicap will exist as long as the question of night flying is not solved. So far, it is still in the experimental stage. Over land, the expense of a night flying operation is very great owing to the large number of houses and emergency fields required. Over a river, the question of emergency fields is automatically eliminated, while the expense of marking the airway with beacons is greatly reduced, for the night-flying airplane can keep the airway constantly illuminated by means of a searchlight carried on board.

A Vision of the Future

THOSE who are skeptical regarding the ability of aircraft to survey a given territory in addition to transporting it by means of loads and machine gun fire, may perhaps find food for reflection in the statement of the latest British troop-carrying plane which appears in this issue. Carrying twenty-five fully equipped soldiers at a speed of about 100 miles per hour, this airplane is merely one of a type Great Britain has been developing during the past year for future recognition.

It does not require much imagination to visualize a fleet of such airplanes in action. One hundred of them could carry a force of 2500 men to occupy entire territory of strategic value and hold it by being provisioned from the air. Single airplanes of this type could land working parties at important railroad junctions and railroads, tunnels, canals, water works, etc. situated in the heart of enemy territory and blow them up, probably with greater certainty than could be accomplished by aerial bombing.

Such a picture is, unfortunately, too far-fetched than it appears at first sight. A month or so before the Armistice, a French bombing plane carrying a crew of three set out from the French lines, landed its party in German occupied territory near a tunnel which was believed to be used for important enemy troop movements. As a matter of fact, the working party found that the tunnel was little used, but that instead a railway could be carrying a large amount of military supplies, whereas they really blew up a lock, remembered in their place and remained to their loss. The intelligence service later reported that traffic on this canal had been interrupted for three weeks as the result of this "Special mission", done by a regular three-engine bombing plane.

It may be concluded from the actual occurrence that when specially designed "desolation planes" will be used for such purposes the results will be infinitely greater in scope and result.

A Comparison of Some Modern Wing Profiles

Eleven Optimum Profiles Selected from N.A.C.A. Reports
Satisfy Requirements of Most Airplanes

By MATTHEW B. SELLERS

The object of the present article is to call attention to a desirable means of comparing the aerodynamic suitability of wing profiles in airplane design, with special reference to the load-carrying for 200 wing profiles chosen in Reports 584 and 585 of the National Advisory Committee for Aeronautics.

The properties of a profile are shown in Fig. 1 in a simple plotted curve having the lift coefficient and the L/D for ordinate. Thus, the higher the curve extends, the greater the

such as No. 249, and Class III those with a camber in the rear two-thirds of the face, such as No. 225 (see Fig. 1).

Of them, Class I appear to be the best all-around, offering moderate flexibility of construction together with aerodynamic quality. Slight changes in the form of the nose and the curve of the high effect their performance, however, and it is probable that still better profiles of this class can be produced as the result of comparative experimentation. These are Class

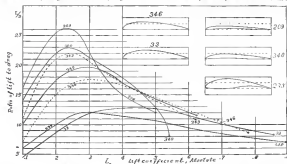


Fig. 1. Aerodynamic characteristics of some outstanding modern wing profiles

L/D, and the further to the right, the greater the lift. This type of graph was used by the writer in the February, 1934, and September, 1936, issues of *Aeronautics*, of New York, to compare the wing profiles tested by R. K. Bell.

While it is not possible to select a single profile that would be "the best," it appears that a small number of "best" profiles could be chosen or developed, which would satisfy the requirements of nearly all airplanes designed. It is with this assumption in mind, that the profiles given in the various reports of aerodynamic laboratories were studied, and those chosen which seem to be the best in their class.

The trouble is question over the following number of profiles: M-7, T. L. Washington Navy Yard 8, N.P.L. 130, Kell 71, Grove 5 and Goetzinger 101. A strict comparison between these profiles is not possible, because of different types of twist, air speed, size and aspect ratio. The L/D ratio at small angles increases with increasing size of model and wind speed, and an allowance has been made for this factor in the accompanying graph and tables.

Most of these profiles can be divided into three classes: Class I includes profiles with flat under surface or "nose"; Class II those with a camber in the front two-thirds of face,

included in Fig. 1 by the drawings 346 and 33, and in the graphs by 312-332, 340-352.

In airplane design, wing sections of different thicknesses are required. The best thin sections give higher lift ratios than the best thick ones, but the latter are generally better at low angles of incidence. With reference to Tables I and II it could be noted that profiles 345, 346, 344 and 33 are progressively thicker.

In Table I the lift coefficients (C_L) are in the first vertical column, the number of each profile being in the apparent horizontal column, and the L/D ratios in line with each lift coefficient. The lift coefficients are in absolute units (no correction made for scale) are lower multiply by 0.0005. At the bottom of Table I the required C_L values are maximum lift, V , speed of air current in feet per second, in feet, A , the aspect ratio of model, and W , the wing area in square feet. Profiles 57 and 546 are from the Washington Navy Yard wind tunnel, 343, 344, 345 and 346 from S.P.L. 32 from Massachusetts Institute of Technology, 338 and 348 from Goetzinger, and 360 and 353 from Kell's Laboratory.

In Table II the dimensions of the different profiles are given in percentage of chord.

Among new to the profiles having their camber in the front two-thirds of the face, that in Nos. 57, 353 and 346, these are very good. Profile No. 353 shows the highest L/D ratios—about 20 in part be due to its high aspect ratio. No. 57 is, however, better at small angles than No. 346. Both are high speed wings, but both are satisfactorily low for low speed construction. No. 346 is slightly better than No. 57, with a 50 per cent better at the handle point. This is a good all-around wing.

The thick Goetzinger profiles No. 338 and 348 have the camber in the rear two-thirds of the face. No. 338 is well suited for a single box spar, and has high maximum lift and a better speed range than No. 33, which is a flat fair profile. No. 348 has a high L/D at low lift, and is good for low speed.

The best speed range is afforded by Kell's No. 303, which has a L/D of 22 at the low lift of 0.1. With this profile a lift range of those in one can be obtained, with L/D of 17 at maximum speed, and L/D of 13 at minimum speed. The most useful model of this profile has an aspect ratio of 8. The order of primary moment is not considered in this comparative study, inasmuch as it is available only for a few of these profiles. However, where it is given, it would seem to be satisfactory.

While only seven profiles are shown in Fig. 1, those given

TABLE I. AERODYNAMIC CHARACTERISTICS OF WING PROFILES

C_L	57	343	344	345	346	348	33	338	348	353	353
1	20	16	11	10	10	9	6.5	6	14	10	10
2	41	31	21	20	20	19	13	12	28	20	20
3	61	46	31	30	30	29	19	18	42	30	30
4	81	61	41	40	40	39	27	26	56	40	40
5	101	76	51	50	50	49	35	34	70	50	50
6	121	91	61	60	60	59	43	42	84	60	60
7	141	106	71	70	70	69	51	50	98	70	70
8	161	121	81	80	80	79	59	58	112	80	80
9	181	136	91	90	90	89	67	66	126	90	90
10	201	151	101	100	100	99	75	74	140	100	100

C_L	57	343	344	345	346	348	33	338	348	353	353
1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
4	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
6	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
7	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
8	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
9	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
10	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

were selected as being perhaps the most representative of the different classes, and not because they are absolutely better than the others described. The inclusion of a greater number of profiles would have made the graph appear too crowded for practical purposes.

The writer has given considerable study in this subject, and has endeavored to include in this article enough of the best profiles to serve the needs of the aeronautical engineer. Careful analysis of the profiles given will show them to still plenty of room for further improvement in wing profile design.

TABLE II. DIMENSIONS OF WING PROFILES

	57	343	344	345	346	348	33	338	348	353	353
	100	100	100	100	100	100	100	100	100	100	100
1	10	10	10	10	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10	10	10	10	10
7	10	10	10	10	10	10	10	10	10	10	10
8	10	10	10	10	10	10	10	10	10	10	10
9	10	10	10	10	10	10	10	10	10	10	10
10	10	10	10	10	10	10	10	10	10	10	10

Collision of Airplanes Recorded by Camera



1. Increased speed

2. Extraordinary photograph shows two British airplanes at the moment of colliding over Hendon, near London. The two ships fall with wings interlocked, but the pilots escaped death.

YOU SAVE \$2.00 ON THIS COMBINATION OFFER

and receive three publications of recognized value which are essential to every one genuinely interested in aeronautics:

	Regular Price	Special Combination Offer
AVIATION, 52 issues, 1933-1934	\$4.00	
AERONAUTICAL RULE BOOK	2.00	\$5.00
WHO'S WHO IN AMERICAN AERONAUTICS	1.00	U. S.
TOTAL	\$7.00	

Canada \$6.00 -- Other Countries \$7.00

AVIATION

as a weekly print more important news, original material, photographs and articles describing new types of aircraft, engines and accessories than is possible by monthly issues.

AVIATION prints from the latest information of interest to the industry and the art. It does not depend upon newspaper clippings. Instead, the news of important events is secured at its source and written by a staff trained to the aeronautical rather than the newspaper point of view.

Its technical articles by recognized authorities have gained for AVIATION a worldwide reputation in engineering circles.

AVIATION is known and respected throughout the aeronautical world for its independence and unbiased editorial comment.

AERONAUTICAL RULE BOOK

by leading aeronautical authorities, including first authentic translation of the STATUTES and GENERAL REGULATIONS of the F. A. I. governing all flying events, events and tests. Methods and procedure for conducting tests. How to obtain F. A. I. statistics, honors, etc.

Chapters on speed formulas, trigonometrical functions, new reference tables and technical notes, balloon gases, etc., etc. 270 pages—bound in blue leather—illustrated. An absolute necessity to every pilot and airplane man.

WHO'S WHO IN AMERICAN AERONAUTICS

contains 850 biographical sketches, numerous photographs and a mass of valuable information unobtainable in any other publication. Included are State and Municipal Aviation Commissioners, Army Air Service, Navy Bureau of Aeronautics, Air Mail Service, National Advisory Committee for Aeronautics, Officers and Committees of Associations and Clubs, Aeronautical Chamber of Commerce, Manufacturers Aircraft Association, Aircraft Underwriters' Association, Aeronautics Association Safety Code, Advertising Service.

THE GARDNER, MOFFAT CO., INC.

225 Fourth Ave., New York

Take advantage of this offer by mailing the coupon NOW

GARDNER, MOFFAT CO.
225 Fourth Avenue,
New York

Herewith—check—money order—cash for . . . for which send AVIATION for 52 issues, one copy of the Aeronautical Rule Book and one copy of Who's Who in American Aeronautics to _____

THE Aircraft Service Directory

WHERE TO PROCURE EQUIPMENT AND SERVICES

JONES TACHOMETER

PIONEER INSTRUMENT COMPANY

100-110 OFFICE AND FACTORY BROOKLYN N.Y.
ALBANY, N.Y. 12204-12205-12206-12207-12208-12209-12210-12211-12212-12213-12214-12215-12216-12217-12218-12219-12220-12221-12222-12223-12224-12225-12226-12227-12228-12229-12230-12231-12232-12233-12234-12235-12236-12237-12238-12239-12240-12241-12242-12243-12244-12245-12246-12247-12248-12249-12250-12251-12252-12253-12254-12255-12256-12257-12258-12259-12260-12261-12262-12263-12264-12265-12266-12267-12268-12269-12270-12271-12272-12273-12274-12275-12276-12277-12278-12279-12280-12281-12282-12283-12284-12285-12286-12287-12288-12289-12290-12291-12292-12293-12294-12295-12296-12297-12298-12299-12300-12301-12302-12303-12304-12305-12306-12307-12308-12309-12310-12311-12312-12313-12314-12315-12316-12317-12318-12319-12320-12321-12322-12323-12324-12325-12326-12327-12328-12329-12330-12331-12332-12333-12334-12335-12336-12337-12338-12339-12340-12341-12342-12343-12344-12345-12346-12347-12348-12349-12350-12351-12352-12353-12354-12355-12356-12357-12358-12359-12360-12361-12362-12363-12364-12365-12366-12367-12368-12369-12370-12371-12372-12373-12374-12375-12376-12377-12378-12379-12380-12381-12382-12383-12384-12385-12386-12387-12388-12389-12390-12391-12392-12393-12394-12395-12396-12397-12398-12399-12400-12401-12402-12403-12404-12405-12406-12407-12408-12409-12410-12411-12412-12413-12414-12415-12416-12417-12418-12419-12420-12421-12422-12423-12424-12425-12426-12427-12428-12429-12430-12431-12432-12433-12434-12435-12436-12437-12438-12439-12440-12441-12442-12443-12444-12445-12446-12447-12448-12449-12450-12451-12452-12453-12454-12455-12456-12457-12458-12459-12460-12461-12462-12463-12464-12465-12466-12467-12468-12469-12470-12471-12472-12473-12474-12475-12476-12477-12478-12479-12480-12481-12482-12483-12484-12485-12486-12487-12488-12489-12490-12491-12492-12493-12494-12495-12496-12497-12498-12499-12500-12501-12502-12503-12504-12505-12506-12507-12508-12509-12510-12511-12512-12513-12514-12515-12516-12517-12518-12519-12520-12521-12522-12523-12524-12525-12526-12527-12528-12529-12530-12531-12532-12533-12534-12535-12536-12537-12538-12539-12540-12541-12542-12543-12544-12545-12546-12547-12548-12549-12550-12551-12552-12553-12554-12555-12556-12557-12558-12559-12560-12561-12562-12563-12564-12565-12566-12567-12568-12569-12570-12571-12572-12573-12574-12575-12576-12577-12578-12579-12580-12581-12582-12583-12584-12585-12586-12587-12588-12589-12590-12591-12592-12593-12594-12595-12596-12597-12598-12599-12600-12601-12602-12603-12604-12605-12606-12607-12608-12609-12610-12611-12612-12613-12614-12615-12616-12617-12618-12619-12620-12621-12622-12623-12624-12625-12626-12627-12628-12629-12630-12631-12632-12633-12634-12635-12636-12637-12638-12639-12640-12641-12642-12643-12644-12645-12646-12647-12648-12649-12650-12651-12652-12653-12654-12655-12656-12657-12658-12659-12660-12661-12662-12663-12664-12665-12666-12667-12668-12669-12670-12671-12672-12673-12674-12675-12676-12677-12678-12679-12680-12681-12682-12683-12684-12685-12686-12687-12688-12689-12690-12691-12692-12693-12694-12695-12696-12697-12698-12699-12700-12701-12702-12703-12704-12705-12706-12707-12708-12709-12710-12711-12712-12713-12714-12715-12716-12717-12718-12719-12720-12721-12722-12723-12724-12725-12726-12727-12728-12729-12730-12731-12732-12733-12734-12735-12736-12737-12738-12739-12740-12741-12742-12743-12744-12745-12746-12747-12748-12749-12750-12751-12752-12753-12754-12755-12756-12757-12758-12759-12760-12761-12762-12763-12764-12765-12766-12767-12768-12769-12770-12771-12772-12773-12774-12775-12776-12777-12778-12779-12780-12781-12782-12783-12784-12785-12786-12787-12788-12789-12790-12791-12792-12793-12794-12795-12796-12797-12798-12799-12800-12801-12802-12803-12804-12805-12806-12807-12808-12809-12810-12811-12812-12813-12814-12815-12816-12817-12818-12819-12820-12821-12822-12823-12824-12825-12826-12827-12828-12829-12830-12831-12832-12833-12834-12835-12836-12837-12838-12839-12840-12841-12842-12843-12844-12845-12846-12847-12848-12849-12850-12851-12852-12853-12854-12855-12856-12857-12858-12859-12860-12861-12862-12863-12864-12865-12866-12867-12868-12869-12870-12871-12872-12873-12874-12875-12876-12877-12878-12879-12880-12881-12882-12883-12884-12885-12886-12887-12888-12889-12890-12891-12892-12893-12894-12895-12896-12897-12898-12899-12900-12901-12902-12903-12904-12905-12906-12907-12908-12909-12910-12911-12912-12913-12914-12915-12916-12917-12918-12919-12920-12921-12922-12923-12924-12925-12926-12927-12928-12929-12930-12931-12932-12933-12934-12935-12936-12937-12938-12939-12940-12941-12942-12943-12944-12945-12946-12947-12948-12949-12950-12951-12952-12953-12954-12955-12956-12957-12958-12959-12960-12961-12962-12963-12964-12965-12966-12967-12968-12969-12970-12971-12972-12973-12974-12975-12976-12977-12978-12979-12980-12981-12982-12983-12984-12985-12986-12987-12988-12989-12990-12991-12992-12993-12994-12995-12996-12997-12998-12999-13000-13001-13002-13003-13004-13005-13006-13007-13008-13009-13010-13011-13012-13013-13014-13015-13016-13017-13018-13019-13020-13021-13022-13023-13024-13025-13026-13027-13028-13029-13030-13031-13032-13033-13034-13035-13036-13037-13038-13039-13040-13041-13042-13043-13044-13045-13046-13047-13048-13049-13050-13051-13052-13053-13054-13055-13056-13057-13058-13059-13060-13061-13062-13063-13064-13065-13066-13067-13068-13069-13070-13071-13072-13073-13074-13075-13076-13077-13078-13079-13080-13081-13082-13083-13084-13085-13086-13087-13088-13089-13090-13091-13092-13093-13094-13095-13096-13097-13098-13099-13100-13101-13102-13103-13104-13105-13106-13107-13108-13109-13110-13111-13112-13113-13114-13115-13116-13117-13118-13119-13120-13121-13122-13123-13124-13125-13126-13127-13128-13129-13130-13131-13132-13133-13134-13135-13136-13137-13138-13139-13140-13141-13142-13143-13144-13145-13146-13147-13148-13149-13150-13151-13152-13153-13154-13155-13156-13157-13158-13159-13160-13161-13162-13163-13164-13165-13166-13167-13168-13169-13170-13171-13172-13173-13174-13175-13176-13177-13178-13179-13180-13181-13182-13183-13184-13185-13186-13187-13188-13189-13190-13191-13192-13193-13194-13195-13196-13197-13198-13199-13200-13201-13202-13203-13204-13205-13206-13207-13208-13209-13210-13211-13212-13213-13214-13215-13216-13217-13218-13219-13220-13221-13222-13223-13224-13225-13226-13227-13228-13229-13230-13231-13232-13233-13234-13235-13236-13237-13238-13239-13240-13241-13242-13243-13244-13245-13246-13247-13248-13249-13250-13251-13252-13253-13254-13255-13256-13257-13258-13259-13260-13261-13262-13263-13264-13265-13266-13267-13268-13269-13270-13271-13272-13273-13274-13275-13276-13277-13278-13279-13280-13281-13282-13283-13284-13285-13286-13287-13288-13289-13290-13291-13292-13293-13294-13295-13296-13297-13298-13299-13300-13301-13302-13303-13304-13305-13306-13307-13308-13309-13310-13311-13312-13313-13314-13315-13316-13317-13318-13319-13320-13321-13322-13323-13324-13325-13326-13327-13328-13329-13330-13331-13332-13333-13334-13335-13336-13337-13338-13339-13340-13341-13342-13343-13344-13345-13346-13347-13348-13349-13350-13351-13352-13353-13354-13355-13356-13357-13358-13359-13360-13361-13362-13363-13364-13365-13366-13367-13368-13369-13370-13371-13372-13373-13374-13375-13376-13377-13378-13379-13380-13381-13382-13383-13384-13385-13386-13387-13388-13389-13390-13391-13392-13393-13394-13395-13396-13397-13398-13399-13400-13401-13402-13403-13404-13405-13406-13407-13408-13409-13410-13411-13412-13413-13414-13415-13416-13417-13418-13419-13420-13421-13422-13423-13424-13425-13426-13427-13428-13429-13430-13431-13432-13433-13434-13435-13436-13437-13438-13439-13440-13441-13442-13443-13444-13445-13446-13447-13448-13449-13450-13451-13452-13453-13454-13455-13456-13457-13458-13459-13460-13461-13462-13463-13464-13465-13466-13467-13468-13469-13470-13471-13472-13473-13474-13475-13476-13477-13478-13479-13480-13481-13482-13483-13484-13485-13486-13487-13488-13489-13490-13491-13492-13493-13494-13495-13496-13497-13498-13499-13500-13501-13502-13503-13504-13505-13506-13507-13508-13509-13510-13511-13512-13513-13514-13515-13516-13517-13518-13519-13520-13521-13522-13523-13524-13525-13526-13527-13528-13529-13530-13531-13532-13533-13534-13535-13536-13537-13538-13539-13540-13541-13542-13543-13544-13545-13546-13547-13548-13549-13550-13551-13552-13553-13554-13555-13556-13557-13558-13559-13560-13561-13562-13563-13564-13565-13566-13567-13568-13569-13570-13571-13572-13573-13574-13575-13576-13577-13578-13579-13580-13581-13582-13583-13584-13585-13586-13587-13588-13589-13590-13591-13592-13593-13594-13595-13596-13597-13598-13599-13600-13601-13602-13603-13604-13605-13606-13607-13608-13609-13610-13611-13612-13613-13614-13615-13616-13617-13618-13619-13620-13621-13622-13623-13624-13625-13626-13627-13628-13629-13630-13631-13632-13633-13634-13635-13636-13637-13638-13639-13640-13641-13642-13643-13644-13645-13646-13647-13648-13649-13650-13651-13652-13653-13654-13655-13656-13657-13658-13659-13660-13661-13662-13663-13664-13665-13666-13667-13668-13669-13670-13671-13672-13673-13674-13675-13676-13677-13678-13679-13680-13681-13682-13683-13684-13685-13686-13687-13688-13689-13690-13691-13692-13693-13694-13695-13696-13697-13698-13699-13700-13701-13702-13703-13704-13705-13706-13707-13708-13709-13710-13711-13712-13713-13714-13715-13716-13717-13718-13719-13720-13721-13722-13723-13724-13725-13726-13727-13728-13729-13730-13731-13732-13733-13734-13735-13736-13737-13738-13739-13740-13741-13742-13743-13744-13745-13746-13747-13748-13749-13750-13751-13752-13753-13754-13755-13756-13757-13758-13759-13760-13761-13762-13763-13764-13765-13766-13767-13768-13769-13770-13771-13772-13773-13774-13775-13776-13777-13778-13779-13780-13781-13782-13783-13784-13785-13786-13787-13788-13789-13790-13791-13792-13793-13794-13795-13796-13797-13798-13799-13800-13801-13802-13803-13804-13805-13806-13807-13808-13809-13810-13811-13812-13813-13814-13815-13816-13817-13818-13819-13820-13821-13822-13823-13824-13825-13826-13827-13828-13829-13830-13831-13832-13833-13834-13835-13836-13837-13838-13839-13840-13841-13842-13843-13844-13845-13846-13847-13848-13849-13850-13851-13852-13853-13854-13855-13856-13857-13858-13859-13860-13861-13862-13863-13864-13865-13866-13867-13868-13869-13870-13871-13872-13873-13874-13875-13876-13877-13878-13879-13880-13881-13882-13883-13884-13885-13886-13887-13888-13889-13890-13891-13892-13893-13894-13895-13896-13897-13898-13899-13900-13901-13902-13903-13904-13905-13906-13907-13908-13909-13910-13911-13912-13913-13914-13915-13916-13917-13918-13919-13920-13921-13922-13923-13924-13925-13926-13927-13928-13929-13930-13931-13932-13933-13934-13935-13936-13937-13938-13939-13940-13941-13942-13943-13944-13945-13946-13947-13948-13949-13950-13951-13952-13953-13954-13955-13956-13957-13958-13959-13960-13961-13962-13963-13964-13965-13966-13967-



Trade Mark

Proof of the Pudding

New uses and new needs for airplanes are becoming more apparent almost daily. In order to keep up with such rapid advancement, airplane builders must be alert and ready with acquired ideas and experience to meet the new conditions.

A few months ago the Navy was confronted with the urgent need of an observation plane to co-operate with its battle-ships in directing gun fire. This Company was selected to develop such

a plane. The result is the all-Metal M01 monoplane, of which six have already been built and which have proven so satisfactory in their trials that thirty eight additional have been ordered for regular service with our fleets.

Here, again, in executing this large order, The Glenn L. Martin Company is demonstrating its ability along production lines, as well as its proficiency in design and development.

THE GLENN L. MARTIN COMPANY

Cleveland

Builders of Quality Aircraft since 1909